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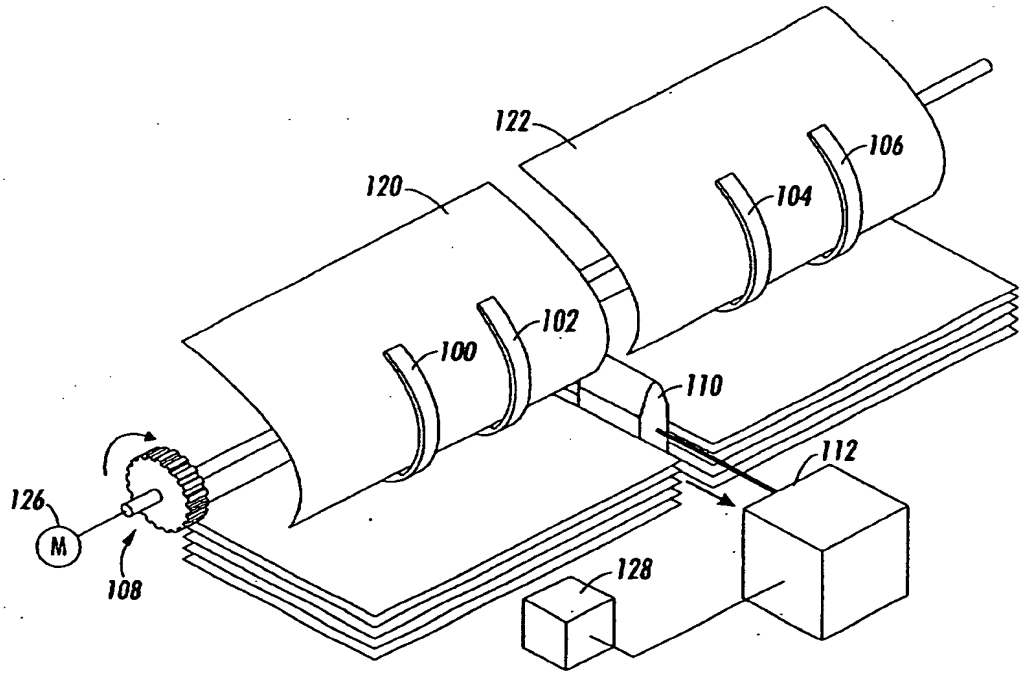
(54) Single/double sheet stacker

(57) A sheet-stacking apparatus capable of receiving two sheets (120,122) at substantially the same time, which includes a disk unit including four substantially identical rotatable disks (100,102,104,106), each disk including a receiving slot for receiving a portion of a sheet therein. The disk unit is arranged so that two of the four disks receive portions of a first sheet (120) and the remaining two disks receive portions of a second sheet (122). Embodiments also include a bin into which the first sheet and the second sheet are deposited and a selectively extendable separator (110) that separates the first sheet and the second sheet into two separate stacks. The apparatus can also include a tamping mechanism.

FIG. 7



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ator, wherein the controller causes the actuator to extend or retract the separator.

[0016] In a further embodiment the apparatus further comprises a tamping mechanism.

[0017] In embodiments, the first, second, third, and fourth disks are symmetrically arranged into two pairs of disks, with said first and second disks on one side of the separator and said third and fourth disks on another side of the separator when the separator is extended.

[0018] In embodiments, the second width is approximately half the first width.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Embodiments will be described in detail herein with reference to the following figures in which like reference numerals denote like elements and wherein:

FIG. 1 is a schematic view of a prior art pre-stacking sheet merging method;
FIG 2 is a schematic view of a prior art pre-stacking sheet sequencing method;
FIG. 3 and 4 are an e nlarged sc hematic side view o f one embodiment of a general disk stacking system, showing a copy sheet entering a rotating disk;
FIG. 5 is a schematic representation of a single large sheet being inverted by a single pair of stacking disks;
FIG. 6 is a schematic representation of two sheets being inverted by a single pair of stacking disks;
FIG. 7 is a schematic representation of a stacking unit having four stacking disks simultaneously stacking a pair of sheets;
FIG. 8 is a schematic representation of a stacking unit having four stacking disks simultaneously stacking one sheet.

DETAILED DESCRIPTION OF EMBODIMENTS

[0020] While the present invention will be described with reference to specific embodiments thereof, it will be understood that the invention is not to be limited to these embodiments. On the contrary, it is intended that the present invention cover all alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims. Other aspects and features of the present invention will become apparent as the description proceeds, wherein like reference numerals have been used throughout to designate identical elements. It is further noted that all references cited anywhere in this specification, and their references, are hereby incorporated by reference where appropriate for relevant teachings of additional or alternative details, features, and/or technical background.

[0021] For a general understanding of the copy sheet output section of an electrostatographic printing machine and, in particular, a typical disk stacker of the type in which the features of the present invention may be incorporated, reference is initially made to FIGS. 3 and 4. Although the apparatus of the present invention is particularly well adapted for use in electrostatographic reproducing machines such as the one shown in FIGS. 3 and 4 and discussed in more detail below, it will become apparent from the following discussion that the disk stacking apparatus disclosed herein is equally well suited for use in a wide variety of copy or print machines as well as in any other system using a rotating disk-type sheet delivery apparatus.

[0022] FIGS. 3 and 4 illustrate the basic components of an exemplary copy sheet output section comprising a copy sheet transport and delivery module 10 which typically receives output copy sheets 11 through a feeder section 12 via feed rollers 25. This feeder section 12 can represent a conventional high-speed copier or printer. The copy sheet transport and delivery module 10 includes a disk stacker section comprising a rotating disk unit 20 having one or more disks 21. Each disk 21 has one or more arcuate fingers 24 located along its periphery defining arcuate receiving slots 23 for receiving output copy sheets 11 therein.

[0023] By way of description of the operation of a typical disk stacker, a copy sheet 11 exits an upstream device, such as a printer or copier through output rollers (not shown), entering the disk stacker module 10 through feeder section 12 where the sheet is engaged by one or more pairs of disk stacker input rollers 25. The copy sheet 11 is then transported into contact with input rollers 29, which drive the sheet into receiving slot 23 of disk 21. After a sheet is fed into a receiving slot 23, the disk 21 rotates to invert and transport the sheet until the leading edge of the sheet is positioned against a fixed registration wall 26. The registration wall 26 strips the sheet from the rotatable disk 21 as the disk continues to rotate through openings in the fixed wall 26, thereby allowing the sheet to drop onto the top of a stack of previously inverted sheets, as shown. Various conventional devices known in the art, such as a stepper motor or a cam drive mechanism can control the rotational movement of disk unit 20. Preferably, a sensor is located upstream of disk unit 20 for detecting the presence of a sheet approaching the disk unit 20. The disk input rollers 29 operate at a constant velocity such that the time required for the sheet 11 lead edge to reach the disk slot after detection by the sheet sensor can be easily determined. Thereafter, as the lead edge of the sheet 11 begins to enter the slot 23, the disk rotates through a 180° cycle.

[0024] The foregoing description generally described features of a disk stacking unit. The features described should not be considered as limitations of the embodiments described herein.

[0025] Current stackers typically have two disks placed so that any single sheet that enters is under control at two points. See FIG. 5. Having two points of control lessens the chance that a sheet will fall out of a disk

[0037] An example of a tamping mechanism 4 0 i s shown i n FIGS. 3 and 4. T his particular tamping mechanism 40 tamps each incoming sheet sideways (laterally) into its proper stack, without tamping the stack edge so as not to interfere with plural sets offsetting. All incoming sheets are so tamped one at a time. The illustrated lateral tamper system 40 for the incoming sheet is shown here as being driven by a cam 42 via pivotal lever arms from the sheet input drive system. Although it could also be operated by a solenoid, and spring loaded in the outboard or non-tamping position, preferably the tamper 40 motion is ramped to have a controlled acceleration movement by cam 42 or the like in order to control sheet inertia better. The shape of the tamper 40 drive cam 42 system can provide better control of sheet inertia. F or variable sheet length end tamping, a multiposition tamper with a programmable stepper motor can be used.

[0038] The preceding description was meant to illustrate an example of a lateral tamping mechanism. However, many other tamping mechanisms may be used with the invention.

Claims

1. A stacking apparatus, comprising:

   four substantially similar, rotatable disks having a common axis, wherein each disk includes a receiving slot for receiving a portion of a sheet therein;
   a disk rotation system that rotates the four disks;
   a selectively extendable separator; and
   an actuator for selectively extending the separator when at least two sheets enters the stacker at substantially the same time and retracting the separator when a single sheet enters the stacker.

2. The apparatus of **claim 1** further comprising a shaft connected to each of the four disks and about which each of the four disks rotates.

3. The apparatus of **claim 2** wherein the disk rotation system includes a stepper motor operably connected to the shaft.

4. The apparatus of **claim 1** further comprising a controller operably connected to the actuator, wherein the controller causes the actuator to extend or retract the separator.

5. The apparatus of **claim 1** further comprising a tamping mechanism.

6. The apparatus of **claim 1**, wherein the four disks are arranged into two pairs of disks, with a first pair on one side of the separator and a second pair on another side of the separator when the separator is extended.

7. The apparatus of **claim 6** wherein s aid first pair and s aid second p air of disks are symmetrically located about a line perpendicular to the common axis.

8. A method for stacking sheets arriving in a two-up manner comprising:

   rotating a first sheet of paper with a first pair of disks until the first sheet is inverted;
   rotating a second sheet of paper with a second pair of disks until the second sheet is inverted, wherein the first sheet and the second sheet are rotated substantially simultaneously;
   separating the first sheet from the second sheet with a selectively extendable separator.

9. A stacking apparatus, comprising:

   first, second, third, and fourth substantially similar, rotatable disks, each disk having a substantially common axis of rotation with the others, wherein each disk includes a receiving slot for receiving a portion of a sheet therein, and wherein said first, second, third, and fourth disks are coaxial;
   a disk rotation system that rotates said first, second, third, and fourth disks;
   a selectively extendable separator; and
   an actuator for selectively retracting the separator when at least one sheet having a first width enters the stacker and extending the separator when at least one sheet having a second width enters the stacker.

10. The apparatus of **claim 9**, wherein the first, second, third, and fourth disks are arranged into two pairs of disks, with said first and second disks on one side of the separator and said third and fourth disks on another side of the separator when the separator is extended.

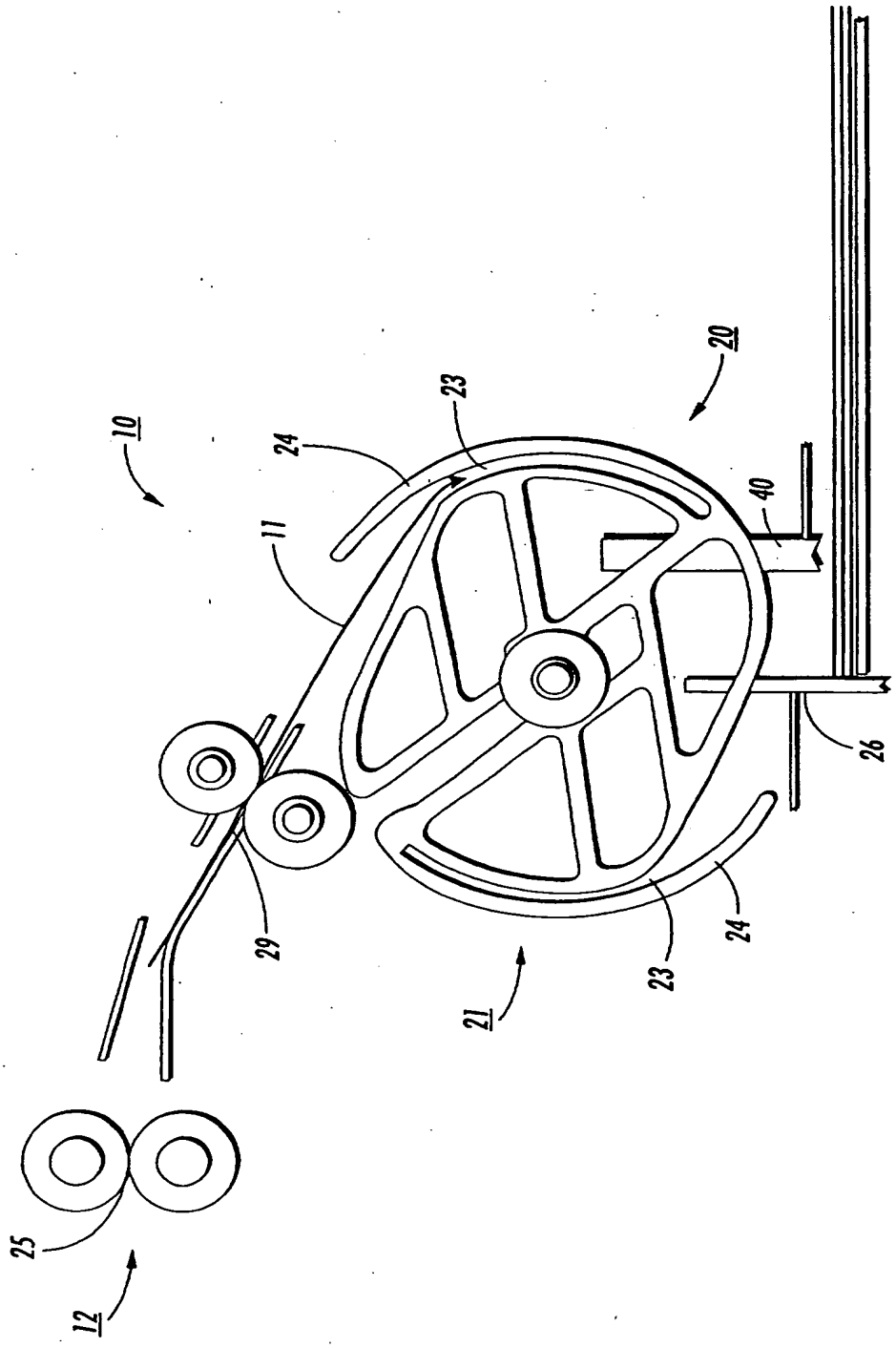
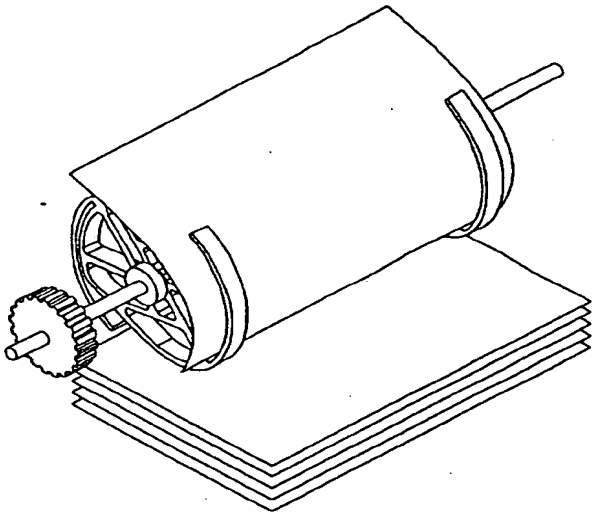


FIG. 3

FIG. 5



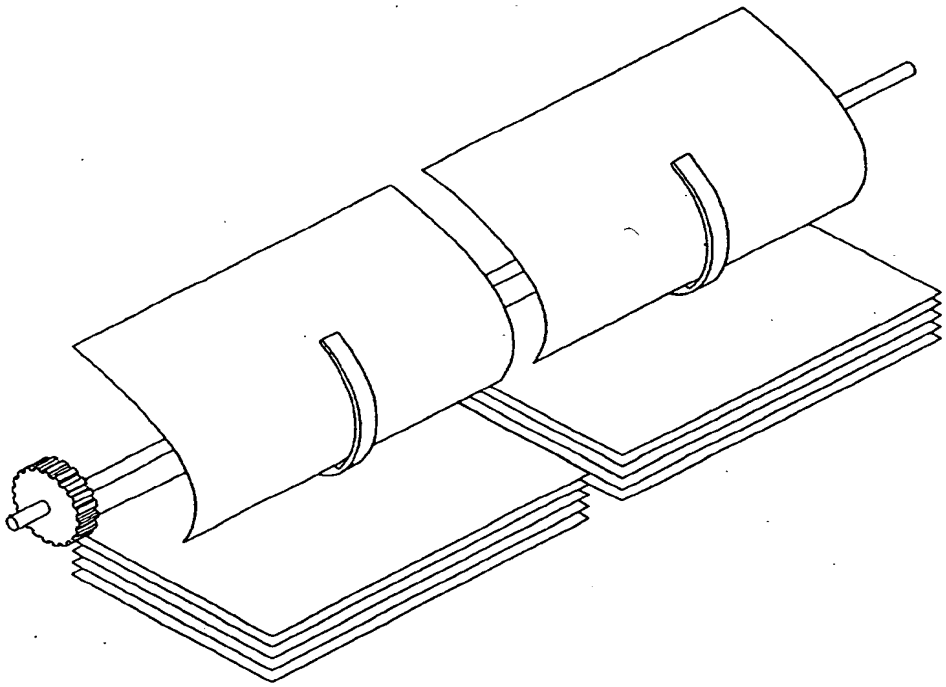


FIG. 6

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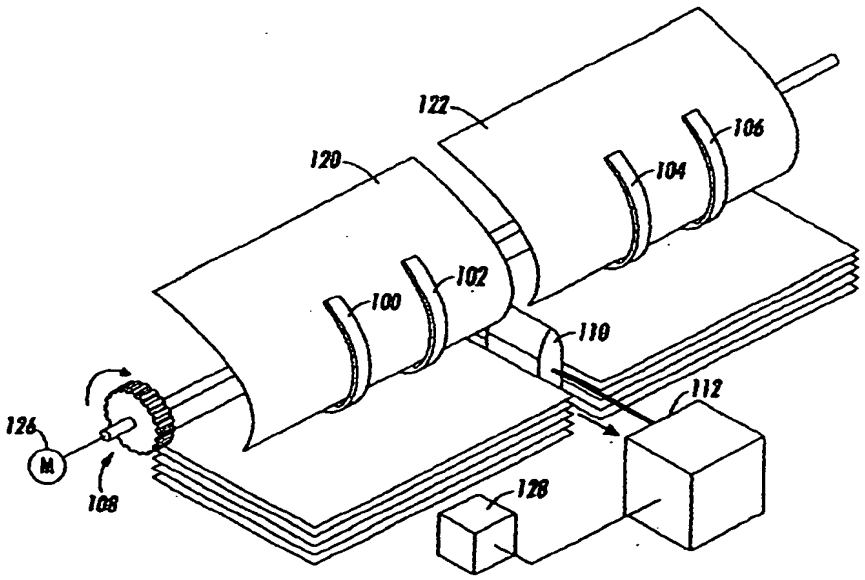

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 02 7512

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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